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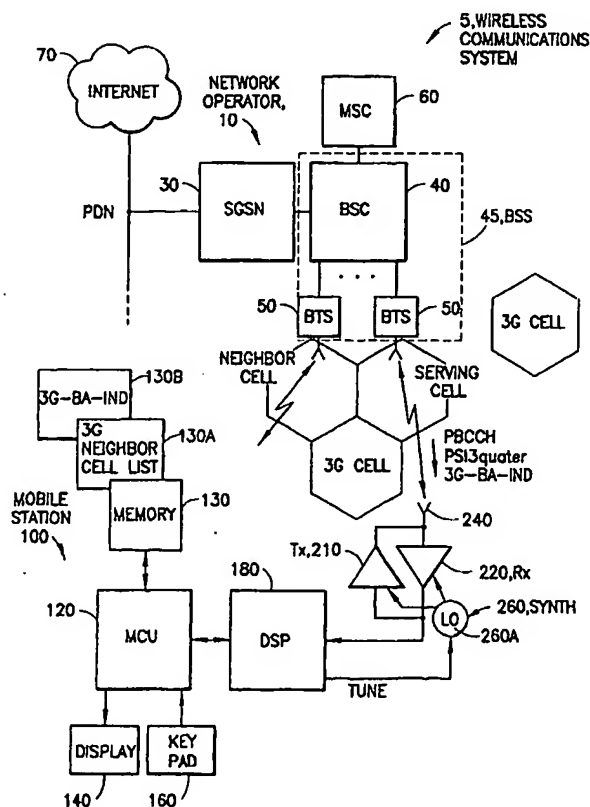
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(54) Title: 3G MEASUREMENTS IN PBCCH CELL IN DEDICATED GSM MODE



(57) Abstract: A General Packet Radio Service GPRS, Global System for Mobile Communications GSM/Universal Mobile Telecommunications System UMTS mobile station (100) in accordance with these teachings includes a radio frequency transceiver (210,220) for communication with a wireless network (10) and a controller (120,180) responsive to a receipt of information from the wireless network for reporting 3G cells when operating in a GSM dedicated mode on a cell that has a Packet Broadcast Control Channel PBCCH. The controller is enabled to report the 3G cells before receipt of the 3G Neighbor Cell list from the MEASUREMENT INFORMATION message. The information includes a 3G Neighbor Cell list received in a PACKET SYSTEM INFORMATION Type 3quater message on the PBCCH, and a 3G\_BA\_IND information element received in the PACKET SYSTEM INFORMATION Type 3quater message. The controller reports the 3G cells using a MEASUREMENT REPORT message that reflects a value of the received 3G\_BA\_IND information element. In another embodiment a PSI3\_CHANGE\_MARK information element is received in the PACKET SYSTEM INFORMATION Type 3quater message, and the LSB of the PSI3\_CHANGE\_MARK information element is used by the mobile station as a 3G\_BA\_IND information element.

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**METHOD AND APPARATUS PROVIDING FOR THE IMMEDIATE START OF 3G  
MEASUREMENTS IN DEDICATED MODE ON A CELL WITH A PACKET  
BROADCAST CONTROL CHANNEL**

**5 TECHNICAL FIELD:**

These teachings relate generally to wireless communications systems and, more specifically, relate to cellular telecommunications of a type wherein dual-system and dual-mode mobile stations are required, when operating in one system, to make measurements from cells of the  
10 other system, such as Global System for Mobile Communications (GSM)/Universal Mobile Telecommunications System (UMTS) compatible mobile stations.

**BACKGROUND:**

15 The following abbreviations are herewith defined.

3G	Third Generation (cellular system)
3GPP	Third Generation Partnership Project
ARFCN	Absolute Radio Frequency Channel Number
BCCH	Broadcast Control Channel
20 BSC	Base Station Controller
BSS	Base Station System
BTS	Base Transceiver Station
CDMA	Code Division Multiple Access
DL	Down Link (to the MS)
25 FDD	Frequency Division Duplex
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
HO	Handover
MS	Mobile Station
30 MSC	Mobile Switching Center
Multi-RAT	Multi-Radio Access Technology
PBCCH	Packet Broadcast Control Channel
PS	Packet Switched
SACCH	Slow Associated Control Channel

SGSN	Serving GPRS Support Node
TDD	Time Division Duplex
TS	Technical Specification
UL	Uplink (from the MS)
5 UMTS	Universal Mobile Telecommunications System

Reference can also be made to 3GPP TR 21.905, V4.4.0 (2001-10), Third Generation Partnership Project; Technical Specification Group Services and System Aspects; Vocabulary for 3GPP Specifications (Release 4).

10

A multi-RAT MS is one having both 2G (GSM) and 3G (UMTS) capabilities, i.e., a 2G-3G multimode MS that can obtain service in either a 2G or a 3G network.

In the GSM dedicated mode, that is during a circuit-switched (CS) connection, a GSM/UMTS  
15 multimode MS is required to measure and report the quality of surrounding 3G cells. This is done so that the wireless network is enabled to command, if necessary, the MS to perform a handover to a UMTS cell. The identifications of the 3G cells that the MS is required to monitor and report back to the wireless network are transmitted to the MS in a 3G Neighbor Cell list. In order to improve the overall system performance and reduce latency when handing over to a 3G  
20 cell it is important that the MS begin the measurement and reporting of 3G cells as soon as possible after entering the GSM dedicated mode, i.e., the MS preferably has immediate access to the 3G Neighbor Cell list.

When operating in the GSM dedicated mode the MS receives the 3G Neighbor Cell list as part  
25 of a MEASUREMENT INFORMATION message. As the amount of information carried in the MEASUREMENT INFORMATION message is substantial, the message contents are transmitted in several shorter message instances. As such, it requires some non-trivial amount of time for the MS to receive the 3G Neighbor Cell list from the MEASUREMENT INFORMATION message and to thereby have access to the 3G Neighbor Cell list. To overcome  
30 this problem, i.e., to enable the MS to start the measurement and reporting of 3G cells immediately after entering the GSM dedicated mode, the 3G Neighbor Cell list that is used for the measurement and reporting of 3G cells in the GSM dedicated mode is also transmitted on

a Broadcast Control Channel (BCCH) with a SYSTEM INFORMATION Type 2quater (SI2quater) message. This enables the MS to construct the 3G Neighbor Cell list, when operating in the idle mode, from the contents of SI2quater message, and to use the constructed list for the purpose of immediately beginning the measuring and reporting of 3G cells after entering the  
5 GSM dedicated mode.

While the use of the BCCH would at first glance appear to solve the problem of obtaining fast access to the 3G Neighbor Cell list, in actuality a General Packet Radio Service (GPRS) attached MS is not required to monitor the BCCH in the idle mode so long as the cell in which the MS  
10 is operating has a Packet Broadcast Control Channel (PBCCH). As a result, a GPRS-capable GSM/UMTS dual-mode MS that is monitoring the PBCCH, as opposed to the BCCH, is not able to construct the 3G Neighbor Cell list from the contents of SI2quater message.

It should be noted that the 3G Neighbor Cell list is also provided on the PBCCH with a PACKET  
15 SYSTEM INFORMATION Type 3quater (PSI3quater) message. This is done for the purpose of enabling the MS to measure and report 3G cells when operating in the GPRS packet idle and packet transfer modes. However, according to the current 3GPP technical specifications the MS is not allowed to use the 3G Neighbor Cell list that is constructed from the contents of the PSI3quater message for the measurement and reporting of 3G cells when in the GSM dedicated  
20 mode. Instead, the MS is expected to use the list constructed from the SI2quater message found on the BCCH. In fact, the 3G Neighbor Cell list constructed from the contents of PSI3quater message is not compatible with the MS messages used for measurement reporting in the GSM dedicated mode. As a consequence, a GPRS attached, GSM/UMTS dual-mode MS is not able to start the measurement and reporting of 3G cells in the GSM dedicated mode, when in a cell  
25 that has a PBCCH, before the 3G Neighbor Cell list is received from the MEASUREMENT INFORMATION message.

It can thus be clearly seen that the current state of the affairs is less than optimum for enabling an efficient and timely measuring and reporting of 3G cells by the dual mode GSM/UMTS MS,  
30 as the GPRS attached, GSM/UMTS dual-mode MS is unable to start the measurement and reporting of 3G cells, when operating in the GSM dedicated mode in a cell that has a PBCCH, before the lengthy MEASUREMENT INFORMATION message has been received. As a result,

the call setup time is increased for the case of calls that are required to be transferred to UMTS before user data can be transferred (e.g., a video call requiring high bit rates provided only by UMTS).

5

## SUMMARY OF THE PREFERRED EMBODIMENTS

The foregoing and other problems are overcome, and other advantages are realized, in accordance with the presently preferred embodiments of these teachings.

- 10 This invention provides a mechanism and an operating protocol for a GPRS attached, GSM/UMTS dual-mode MS to begin the measurement and reporting of 3G cells immediately after entering the GSM dedicated mode, in a cell that has a PBCCH, by enabling the 3G Neighbor Cell list received on the PBCCH to be also be used as initial information in the GSM dedicated mode, in a manner similar to the way in which the 3G Neighbor Cell list is used that  
15 is received from the BCCH.

A General Packet Radio Service GPRS, Global System for Mobile Communications GSM/Universal Mobile Telecommunications System UMTS capable mobile station in accordance with these teachings includes a radio frequency transceiver for communication with  
20 a wireless network and a controller responsive to a receipt of information from the wireless network for reporting 3G cells when operating in a GSM dedicated mode on a cell that has a Packet Broadcast Control Channel PBCCH. The controller is enabled to report the 3G cells before the receipt of the 3G Neighbor Cell list from the MEASUREMENT INFORMATION message. The information includes a 3G Neighbor Cell list received in a PACKET SYSTEM  
25 INFORMATION Type 3quater message on the PBCCH, and a 3G\_BA\_IND information element received in the PACKET SYSTEM INFORMATION Type 3quater message. The controller reports the 3G cells using a MEASUREMENT REPORT message that reflects a value of the received 3G\_BA\_IND information element. The controller may also report the 3G cells using an ENHANCED MEASUREMENT REPORT message that reflects a value of the received  
30 3G\_BA\_IND information element.

In another embodiment a PSI3\_CHANGE\_MARK information element is received in the

PACKET SYSTEM INFORMATION Type 3quarter message, and the LSB of the PSI3\_CHANGE\_MARK information element is used by the mobile station as the 3G\_BA\_IND information element.

- 5 In general, the controller reports the 3G cells to the wireless network before a number of instances of the MEASUREMENT INFORMATION message are received that are defined by a 3G\_WAIT parameter.

### BRIEF DESCRIPTION OF THE DRAWINGS

10

The foregoing and other aspects of these teachings are made more evident in the following Detailed Description of the Preferred Embodiments, when read in conjunction with the attached Drawing Figures, wherein:

- 15 Fig. 1 is a block diagram of a wireless communications system and a mobile station that are suitable for practicing the teachings of this invention; and

Fig. 2 is a logic flow diagram in accordance with a method of this invention.

20

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to Fig. 1, there is illustrated a simplified block diagram of an embodiment of a wireless communications system 5 that is suitable for practicing this invention. The wireless communications system 5 includes at least one mobile station (MS) 100. Fig. 1 also shows an exemplary network operator having, for example, a Serving GPRS Support Node (SGSN) 30 for connecting to a telecommunications network, such as a Public Packet Data Network or PDN, at and least one base station system (BSS) 45 containing a Base Station Controller (BSC) 40 and a plurality of base transceiver stations (BTS) 50 that transmit in a forward or downlink direction both physical and logical channels to the mobile station 100 in accordance with a predetermined air interface standard. A reverse or uplink communication path also exists from the mobile station 100 to the network operator, which conveys mobile originated access requests and traffic.

The air interface standard can conform to any suitable standard or protocol, and may enable both voice and data traffic, such as data traffic enabling Internet 70 access and web page downloads. In the presently preferred embodiment of this invention the air interface standard is a Time Division Multiple Access (TDMA) air interface that supports a GSM or an advanced GSM  
5 protocol and air interface, although these teachings are not intended to be limited to TDMA or to GSM or GSM-related wireless systems. The network operator 10 may be assumed to also include a Mobile Switching Center (MSC) 60 for conducting CS voice communications.

For the purposes of this invention the MS 100 is assumed to be a dual mode GSM/UMTS MS,  
10 and to be compatible with GPRS. It is further assumed that there will exist some number of 3G cells that the MS 100 is expected to measure and report on when operating in the GSM dedicated mode, as was discussed above, and that the network 10 can command the MS 100 to handover to the UMTS when desired, such as when a call needs to be transferred to UMTS to accommodate a required bit rate for a user data transfer.

15

The mobile station 100 typically includes a microcontrol unit (MCU) 120 having an output coupled to an input of a display 140 and an input coupled to an output of a keyboard or keypad 160. The mobile station 100 may be a handheld radiotelephone, such as a cellular telephone or a personal communicator. The mobile station 100 could also be contained within a card or  
20 module that is connected during use to another device. For example, the mobile station 10 could be contained within a PCMCIA or similar type of card or module that is installed during use within a portable data processor, such as a laptop or notebook computer, or even a computer that is wearable by the user.

25 The MCU 120 is assumed to include or be coupled to some type of a memory 130, including a read-only memory (ROM) for storing an operating program, as well as a random access memory (RAM) for temporarily storing required data, scratchpad memory, received packet data, packet data to be transmitted, and the like. A separate, removable SIM (not shown) can be provided as well, the SIM storing, for example, a preferred Public Land Mobile Network (PLMN) list and  
30 other subscriber-related information. The ROM is assumed, for the purposes of this invention, to store a program enabling the MCU 120 to execute the software routines, layers and protocol stacks that are required to operate with software routines, layers and protocol stacks in the



network 10 so as to implement the methods in accordance with this invention. The ROM also includes software for providing overall control over the MS 100, as well as for providing a suitable user interface, via display 140 and keypad 160, with a user. Although not shown, a microphone and speaker are typically provided for enabling the user to conduct voice calls in a conventional manner.

The memory 130 is assumed, for the purposes of this invention, to provide storage for the 3G Neighbor Cell list 130A, that is decoded from the PBCCH by the MCU/DSP in accordance with the teachings of this invention. The network 10 is also assumed, for the purposes of this invention, to transmit a PSI3quater message as part of the PBCCH that is modified to include an information element referred to here as the 3G-BA\_IND. The memory 130 thus also provides storage for storing the value of the 3G-BA\_IND 130B. These aspects of the invention are described in greater detail below.

15 The mobile station 100 also contains a wireless section that includes a digital signal processor (DSP) 180, or equivalent high speed processor or logic, as well as a wireless transceiver that includes a transmitter 200 and a receiver 220, both of which are coupled to an antenna 240 for communication with the network operator. At least one local oscillator (LO) 260 included in a frequency synthesizer is provided for tuning the transceiver over the frequency bands that enable GSM/UMTS operation. Data, such as digitized voice and packet data, as well as signaling information and messages, are transmitted and received through the antenna 240.

In accordance with this invention the GPRS attached, GSM/UMTS dual-mode MS 100 is enabled to start the measurement and reporting to the network 10 of the 3G cells immediately after entering the GSM dedicated mode in a cell that has a PBCCH. In practice this implies that the network 10 is able to command the MS 100 to perform a handover to UMTS earlier than would be possible otherwise.

In accordance with an aspect of this invention the MS 100 is enabled to use the 3G Neighbor Cell list 130A that is received in a PSI3quater message on the PBCCH as initial information when in the GSM dedicated mode, in a manner similar to the 3G Neighbor Cell list received in a SI2quater message from the BCCH.

This aspect of the invention actually has two related and interacting parts or steps. First, the MS 100 uses the 3G Neighbor Cell list 130A received on the PBCCH as the initial information in the GSM dedicated mode and, second, the 3G Neighbor Cell list received on the PBCCH is made compatible with the measurement reporting messages used in the GSM dedicated mode (i.e., the  
5 MEASUREMENT REPORT and ENHANCED MEASUREMENT REPORT messages).

In the presently preferred embodiment the first step involves changes to the 3GPP TS 8.13.0 v8.11.0 specification, as discussed in detail below, while the second step involves changes to the 3GPP TS 8.13.0 v8.10.0 specification, and adds the 3G\_BA\_IND field to the PSI3quarter  
10 message. The 3G Neighbor Cell list is identified by the 3G\_BA\_IND field in measurement reporting messages transmitted by the MS 100 to the network 10 in the GSM dedicated mode.

Referring to the first step, and to the modifications to the 3GPP TS 8.13.0 v8.11.0 specification referred to above, more specifically Section 3.4.1.2.1, "Parameters for Measurements and  
15 Reporting", the parameters from the Measurement Information or SI2quarter, as well as the PSI3quarter messages in accordance with this invention, allow the building of lists that are used for Measurement reporting and Enhanced Measurement reporting. A full set, i.e., all instances of the MEASUREMENT INFORMATION messages (respectively: SI2quarter) is defined by a number of different instances indicated by the parameter MI\_COUNT (respectively  
20 SI2quarter\_COUNT). Two different instances of MEASUREMENT INFORMATION (respectively: SI2quarter) messages are two MEASUREMENT INFORMATION (respectively: SI2quarter messages with different MI\_INDEX (respectively: SI2quarter\_INDEX) parameter values.

25 In the Idle mode, on a cell without a PBCCH allocated, a multi-RAT MS 100 reads and decodes a full set of SI2quarter messages to form the 3G Neighbor Cell list 130A. When the 3G\_BA\_IND parameter is changed in the Idle mode, the MS 100 re-reads all instances and rebuilds the 3G Neighbor Cell list 130A.

30 In accordance with the teachings of this invention, on a cell with PBCCH allocated, a GPRS attached multi-RAT MS 100 constructs the 3G Neighbor Cell list 130A from PSI3quarter messages to form the 3G Neighbor Cell list 130A.

The 3G Neighbor Cell list 130A, whether constructed from the SI2quater or PSI3quater messages, is then used for reporting when the MS 100 enters the dedicated mode, until the MS 100 has received a given number of instances of MEASUREMENT INFORMATION messages that contain the 3G Neighbor Cell description. The number of message instances is defined by  
5 the 3G-WAIT parameter. When the 3G\_BA\_IND parameter is changed when on the SACCH, the MS 100 re-reads all instances and rebuilds the 3G Neighbor Cell list 130A, and uses the new list for reporting based on the 3G-WAIT parameter.

The remaining portion of Section 3.4.1.2.1, "Parameters for Measurements and Reporting", can  
10 be practiced as currently specified.

Section 3.4.1.2.1.1 of the 3GPP TS 8.13.0 v8.11.0 specification, "Deriving the 3G Neighbor Cell list from the 3G Neighbor Cell Description", is modified as follows (this applies only to a multi-RAT MS 100). One or more instances of the Measurement Information message, or the  
15 SI2quater message, or, in accordance with this invention, the PSI3quater message may provide the 3G Neighbor Cell Description information and is used to build the 3G Neighbor Cell list 130A. As currently specified the 3G Neighbor Cell list may contain up to 96 3G Neighbor Cells.

With specific regard to building the 3G Neighbor Cell list, each 3G Neighbor Cell Description  
20 received is added to the 3G Neighbor Cell list, starting with the index equal to the parameter Index\_Start\_3G. If this parameter is not present then the value 0 is used in its place.

For each 3G Neighbor Cell Description, the cells are indexed in the 3G Neighbor Cell list 130A in the following order:

- 25 1) UTRAN FDD cells: FDD ARFCNs are indexed in the order of occurrence in the 3G Neighbor Cell description. Then for each FDD ARFCN, the cells are indexed in the order of increasing values of the decoded FDD\_CELL\_INFORMATION parameters.
- 2) UTRAN TDD cells: TDD ARFCNs are indexed in the order of occurrence in the 3G Neighbor Cell description. Then for each TDD ARFCN, the cells are indexed in the order of increasing  
30 values of the decoded TDD\_CELL\_INFORMATION parameters.
- 3) CDMA 2000 cells: The cells are indexed in the order of occurrence in the 3G Neighbor Cell description.

Turning now to the second step referred to above, changes are made to the 3GPP TS 8.13.0 v8.10.0 specification in order to add the above-referenced 3G\_BA\_IND field to the PSI3quater message. The 3G Neighbor Cell list is identified by the 3G\_BA\_IND field in measurement reporting messages used by the MS 100 when operating in the GSM dedicated mode.

5

Section 5.6.3 of the 3GPP TS 8.13.0 v8.10.0 specification, "Additional measurement and reporting parameters", states that some parameters from the PACKET MEASUREMENT ORDER, PACKET CELL CHANGE ORDER, SI2quater, PSI3bis, PSI3ter, PSI3quater or PSI5 messages allow for building the GPRS Measurement Parameters, GPRS 3G Measurement  
10 Parameters and neighbor cell lists used for Network Control (NC) measurement reporting.

Section 5.6.3.1, "Deriving the 3G Neighbor Cell list from the 3G Neighbor Cell description", states that in a cell without a PBCCH allocated, the 3G Neighbor Cell list is given by one or more instances of the SI2quater message with the same 3G\_BA\_IND value. In a cell with a  
15 PBCCH allocated, the 3G Neighbor Cell list is given by one or more instances of the PSI3quater message with the same PSI3\_CHANGE\_MARK value and, in accordance with this aspect of the invention, 3G\_BA\_IND value.

In a cell without a PBCCH allocated, the MS 100 only combines 3G Neighbor cells from  
20 SI2quater messages that indicate the same value of the 3G\_BA\_IND, without any message indicating a different value of the 3G\_BA\_IND received in between.

In a cell with a PBCCH allocated, the MS 100 only combines 3G Neighbor cells from PSI3quater messages indicating the same PSI3\_CHANGE\_MARK value and, in accordance with  
25 this aspect of the invention, the same 3G\_BA\_IND value.

Further in accordance with this invention a modification is made to the PSI3quater message content to support the foregoing modifications and enhancements to the current standards and specifications. More specifically, the Section 1.2.21b "Packet System Information Type 3  
30 quater", describes the PSI3 quater message as follows. This message is sent by the network 10 on the PBCCH or PACCH for giving information regarding 3G Neighbor Cells and additional measurement and reporting parameters. If not all information fits into one instance of the

PSI3quater message, the PSI3quater message can be repeated. Certain special requirements for the transmission of this message apply on the PBCCH, and are described in 3GPP TS 05.02.

Table 11.2.21b.1 gives the PSI3 quater information elements.

5

< PSI3 quater message content > ::=

,< PAGE\_MODE : bit (2) >

,< PSI3\_CHANGE\_MARK : bit (2) >

,< PSI3\_QUATER\_INDEX : bit (4) >

10 ,&lt; PSI3\_QUATER\_COUNT : bit (4) &gt;

In accordance with this invention the PSI3 quater message content is modified to add a one bit field:

,<3G\_BA\_IND:bit>,

15 which, in the presently preferred but non-limiting embodiment, is inserted after the PSI3\_CHANGE\_MARK field.

The Table 11.2.21b.2 gives the details of the PSI3quater information elements, and is modified to include the 3G\_BA\_IND (1 bit field) description. The 3G\_BA\_IND is needed to identify a set of 3G Neighbor Cell information used for MS 100 reporting in the dedicated mode. The value received by the MS 100 is then reflected in the MEASUREMENT REPORT and ENHANCED MEASUREMENT REPORT message, as was described above with regard to 3GPP TS 8.13.0 Section 3.4.1.2.1, "Parameters for Measurements and Reporting".

25 The 3G\_BA\_IND parameter has been specified above to be a 1-bit field. The values of the 3G\_BA\_IND in the PSI3quater message and in the SI2quater message are preferably equal so that the 3G Neighbor Cell list received on the BCCH/PBCCH can be unambiguously distinguished from the 3G Neighbor Cell list provided on the SACCH, i.e., in the MEASUREMENT INFORMATION message. Note that the network 10 does not know whether  
30 the MS 100 has decoded the initial 3G Neighbor Cell list from the BCCH or from the PBCCH.

Note, however, that since the MS 100 is not required to decode both BCCH and PBCCH, the 3G

Neighbor Cell list received in the Idle/packet Idle mode can be readily distinguished from the 3G Neighbor Cell list provided with the MEASUREMENT INFORMATION message. If, however, the 3G Neighbor Cell list given on the BCCH is required to be distinguished from the 3G Neighbor Cell list given on PBCCH, the 3G\_BA\_IND field can be expanded to be two or  
5 more bits, thereby enabling additional information to be specified. This change would require changes to following messages: SI2quater, PSI3quater, MEASUREMENT REPORT, ENHANCED MEASUREMENT REPORT, MEASUREMENT INFORMATION, PACKET MEASUREMENT REPORT, PACKET ENHANCED MEASUREMENT REPORT, PACKET CELL CHANGE ORDER and PACKET MEASUREMENT ORDER to accommodate the use  
10 of more than one bit for the 3G\_BA\_IND field.

In accordance with a further embodiment of this invention a modification to the PSI3quater message is avoided. More particularly, Section 5.6.3.1 as currently specified states that in a cell with a PBCCH allocated the MS 100 only combines 3G Neighbor cells from PSI3quater  
15 messages that indicate the same PSI3\_CHANGE\_MARK value. In accordance with this embodiment of the invention, for use in reporting 3G cells in the dedicated mode, the MS 100 converts the least significant bit (LSB) of the 2-bit PSI3\_CHANGE\_MARK field to the one bit 3G\_BA\_IND, and uses this value when reporting 3G cells with the MEASUREMENT REPORT or ENHANCED MEASUREMENT REPORT messages.

20

Referring to Fig. 2, it can be appreciated that an aspect of this invention is providing a method for operating the GPRS attached, GSM/UMTS capable mobile station 100. The method includes, at Block A, receiving information from the wireless network 10 over the PBCCH; at Block B, constructing the 3G Neighbor Cell list from the received information; at Block C, entering the  
25 GSM dedicated mode of operation; and at Block D, measuring and reporting 3G cells to the wireless network 10 using the 3G Neighbor Cell list, before receiving the 3G Neighbor Cell list from the MEASUREMENT INFORMATION message transmitted by the network 10.

The received information is contained in a PACKET SYSTEM INFORMATION Type 3quater  
30 message sent on the PBCCH. In one embodiment a 3G\_BA\_IND information element is added to and received in the PACKET SYSTEM INFORMATION Type 3quater message. In another embodiment the MS 100 interprets the LSB of the already existent PSI3\_CHANGE\_MARK

field as the 3G\_BA\_IND information element field.

Block D, where the MS 100 reports the 3G cells, uses a MEASUREMENT REPORT message that reflects a value of the received 3G\_BA\_IND information element. The MS 100 may also  
5 report the 3G cells using an ENHANCED MEASUREMENT REPORT message that reflects a value of the received 3G\_BA\_IND information element.

While described in the context of presently preferred embodiments of this invention, those skilled in the art should appreciate that changes in form and details may be made, and that these  
10 changes will still fall within the teachings of this invention. For example, the message format and numbers of bits of certain information element fields could be varied from those disclosed above, and so long as both the wireless network 10 and the mobile station 100 are aware of the changes, then this invention can be practiced.

## CLAIMS

What is claimed is:

1. A General Packet Radio Service GPRS, Global System for Mobile Communications GSM/Universal Mobile Telecommunications System UMTS mobile station comprising a radio frequency transceiver for communication with a wireless network, said mobile station comprising a controller responsive to a receipt of information from said wireless network for reporting 3G cells when operating in a GSM dedicated mode on a cell that has a Packet Broadcast Control Channel PBCCH, said controller reporting before receipt of the 3G Neighbor Cell list from the MEASUREMENT INFORMATION message.
2. A GPRS, GSM/UMTS mobile station as in claim 1, where said information comprises a 3G Neighbor Cell list received in a PACKET SYSTEM INFORMATION Type 3quarter message on the PBCCH, and a 3G\_BA\_IND information element received in the PACKET SYSTEM INFORMATION Type 3quarter message.
3. A GPRS, GSM/UMTS mobile station as in claim 1, where said controller reports before a number of instances of the MEASUREMENT INFORMATION message are received that is defined by a 3G\_WAIT parameter.
4. A GPRS, GSM/UMTS mobile station as in claim 2, where said controller reports said 3G cells using a MEASUREMENT REPORT message that reflects a value of the received 3G\_BA\_IND information element.
5. A GPRS, GSM/UMTS mobile station as in claim 2, where said controller reports said 3G cells using an ENHANCED MEASUREMENT REPORT message that reflects a value of the received 3G\_BA\_IND information element.
6. A GPRS, GSM/UMTS mobile station as in claim 1, where said information comprises a 3G Neighbor Cell list received in a PACKET SYSTEM INFORMATION Type 3quarter message on the PBCCH, and further comprises the LSB of a PSI3\_CHANGE\_MARK information element received in the PACKET SYSTEM INFORMATION Type 3quarter message, the LSB of the



PSI3\_CHANGE\_MARK information element being used by said controller as a 3G\_BA\_IND information element.

7. A GPRS, GSM/UMTS mobile station as in claim 6, where said controller reports said 3G cells using a MEASUREMENT REPORT message that reflects a value of the 3G\_BA\_IND information element.

8. A GPRS, GSM/UMTS mobile station as in claim 6, where said controller reports said 3G cells using an ENHANCED MEASUREMENT REPORT message that reflects a value of the 3G\_BA\_IND information element.

9. A wireless network for operation with a General Packet Radio Service GPRS, Global System for Mobile Communications GSM/Universal Mobile Telecommunications System UMTS mobile station, said wireless network comprising a radio frequency transceiver for communication with said mobile station, said wireless network comprising a controller for sending through said transceiver a MEASUREMENT INFORMATION message, a Broadcast Control Channel (BCCH) containing a SYSTEM INFORMATION Type 2quarter (SI2quarter) message, both for use in constructing a 3G Neighbor Cell list, said controller further sending a Packet Broadcast Control Channel PBCCH comprising a PACKET SYSTEM INFORMATION Type 3quarter message for use in constructing the 3G Neighbor Cell list, as well as a related 3G\_BA\_IND information element, said controller being responsive to a receipt from said mobile station of a MEASUREMENT REPORT message or an ENHANCED MEASUREMENT REPORT message for reporting 3G cells when operating in a GSM dedicated mode, said MEASUREMENT REPORT message or ENHANCED MEASUREMENT REPORT message being received from said mobile station prior to said mobile station constructing a complete 3G Neighbor Cell list from received MEASUREMENT INFORMATION.

10. A wireless network as in claim 9, where said controller receives a report of 3G cells prior to said mobile station receiving a number of instances of the MEASUREMENT INFORMATION message that is defined by a 3G\_WAIT parameter.

11. A wireless network as in claim 9, where the MEASUREMENT REPORT message received

by said controller reflects a value of the 3G\_BA\_IND information element.

12. A wireless network for operation with a General Packet Radio Service GPRS, Global System for Mobile Communications GSM/Universal Mobile Telecommunications System UMTS mobile station, said wireless network comprising a radio frequency transceiver for communication with said mobile station, said wireless network comprising a controller for sending through said transceiver a MEASUREMENT INFORMATION message, a Broadcast Control Channel (BCCH) containing a SYSTEM INFORMATION Type 2quater (SI2quater) message, both for use in constructing a 3G Neighbor Cell list, said controller further sending a Packet Broadcast Control Channel PBCCH comprising a PACKET SYSTEM INFORMATION Type 3quater message for use in constructing the 3G Neighbor Cell list, the PACKET SYSTEM INFORMATION Type 3quater message comprising a PSI3\_CHANGE\_MARK information element, said controller being responsive to a receipt from said mobile station of a MEASUREMENT REPORT message or an ENHANCED MEASUREMENT REPORT message for reporting 3G cells when operating in a GSM dedicated mode, said MEASUREMENT REPORT message or ENHANCED MEASUREMENT REPORT message being received from said mobile station prior to said mobile station constructing a complete 3G Neighbor Cell list from received MEASUREMENT INFORMATION, where the value of the LSB of the PSI3\_CHANGE\_MARK information element is reported back to said controller as a 3G\_BA\_IND information element.

13. A method for operating a General Packet Radio Service GPRS, Global System for Mobile Communications GSM/Universal Mobile Telecommunications System UMTS mobile station, comprising:

receiving information from a wireless network over a Packet Broadcast Control Channel (PBCCH);

constructing a 3G Neighbor Cell list from the received information; and

after entering a GSM dedicated mode of operation, reporting 3G cells to the wireless network using the 3G Neighbor Cell list, before receipt of the 3G

Neighbor Cell list from a MEASUREMENT INFORMATION message transmitted by the wireless network.

14. A method as in claim 13, where said information is contained in a PACKET SYSTEM INFORMATION Type 3quarter message sent on the PBCCH, and a 3G\_BA\_IND information element received in the PACKET SYSTEM INFORMATION Type 3quarter message.

15. A method as in claim 14, where said step of reporting occurs before said mobile station receives a number of instances of the MEASUREMENT INFORMATION message that is defined by a 3G\_WAIT parameter.

16. A method as in claim in claim 14, where said step of reporting reports said 3G cells using a MEASUREMENT REPORT message that reflects a value of the received 3G\_BA\_IND information element.

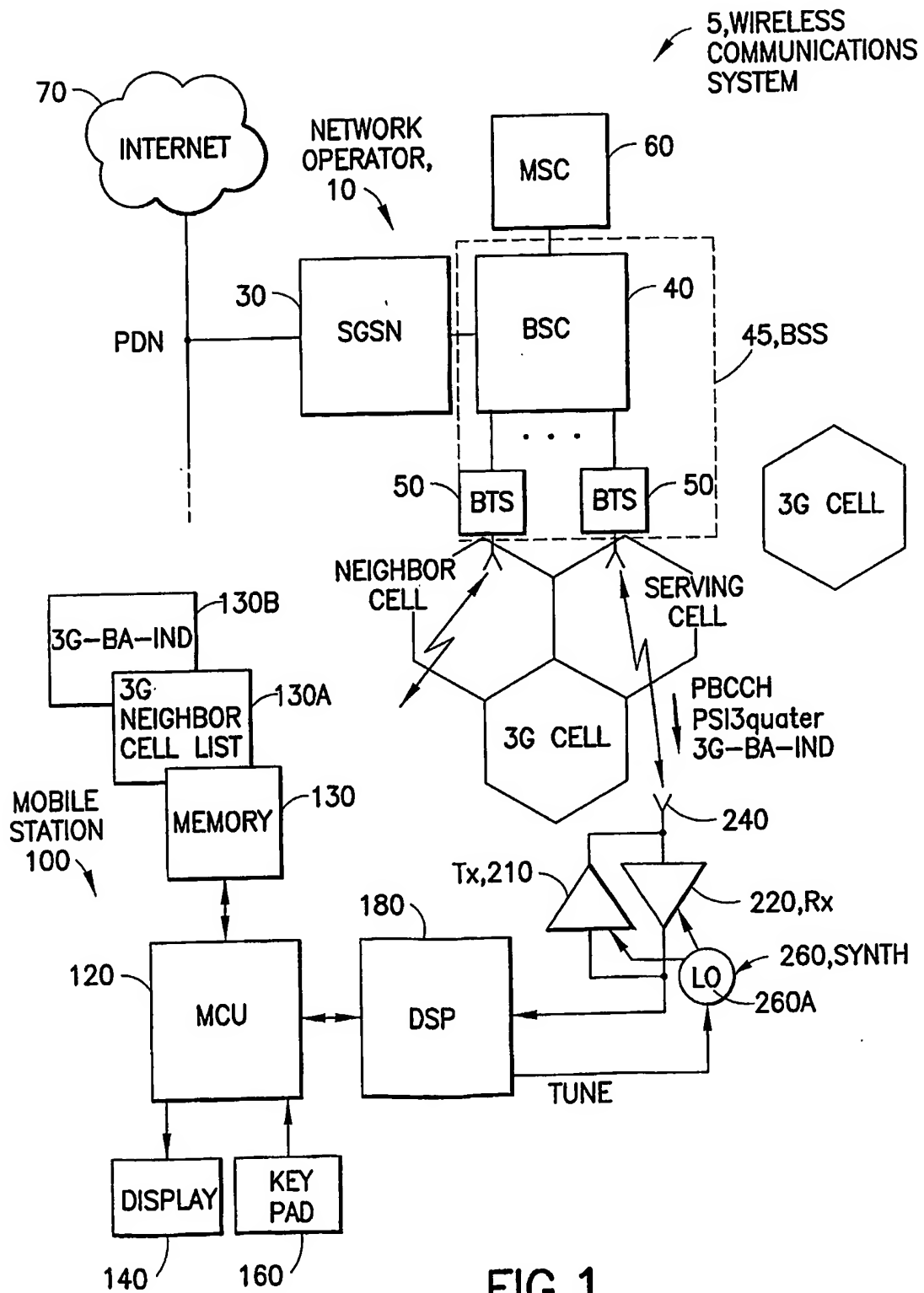
17. A method as in claim in claim 14, where said step of reporting reports said 3G cells using an ENHANCED MEASUREMENT REPORT message that reflects a value of the received 3G\_BA\_IND information element.

18. A method as in claim 13, where said information comprises a 3G Neighbor Cell list received in a PACKET SYSTEM INFORMATION Type 3quarter message on the PBCCH, and further comprises the LSB of a PSI3\_CHANGE\_MARK information element received in the PACKET SYSTEM INFORMATION Type 3quarter message, the LSB of the PSI3\_CHANGE\_MARK information element being used a 3G\_BA\_IND information element.

19. A method as in claim 18, where said step of reporting reports said 3G cells using a MEASUREMENT REPORT message that reflects a value of the 3G\_BA\_IND information element.

20. A method as in claim 18, where said step of reporting reports said 3G cells using an ENHANCED MEASUREMENT REPORT message that reflects a value of the 3G\_BA\_IND information element.

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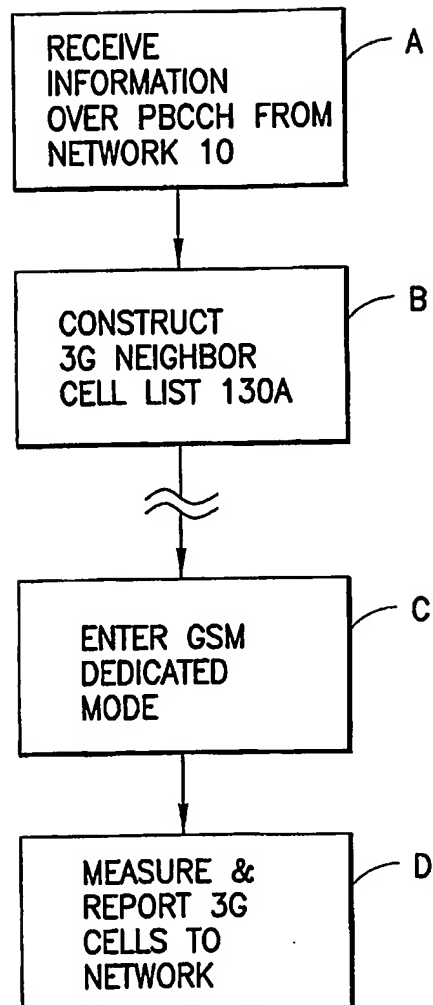


FIG.2

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB03/01129

<b>A. CLASSIFICATION OF SUBJECT MATTER</b>		
IPC(7) : H04B 7/216		
US CL : 370/342		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b>		
Minimum documentation searched (classification system followed by classification symbols)		
U.S. : 370/328, 331, 332, 333, 334, 335, 342, 465		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
3GPP		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Separation of 3G information from PSI3ter into PSI3quater message, January 15-19, 2001, 3GPP TSG-GERAN Meeting #3, Tdoc GP-010316, Agenda item 7.2.5.1, pp. 1-21.	9, 11
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Y		2, 4, 5, 14, 16, 17
Y	US 6,424,637 B1 (PECEN et al) 23 July 2002 (23.07.2002), column 1, lines 17-22, column 2, lines 4-6, column 6, lines 27-34, figure 3.	1, 2, 4, 5, 13, 14, 16, 17
Y	US 5,930,721 A (FRIED et al) 27 July 1999 (27.07.1999), column 11, lines 20-24, column 5, lines 44-45.	1, 2, 4, 5, 13, 14, 16, 17
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents:		
"A"	document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"B"	earlier application or patent published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"Z" document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed	
Date of the actual completion of the international search		Date of mailing of the international search report
25 July 2003 (25.07.2003)		14 AUG 2003
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703)305-3230		Authorized officer Keith M. George Telephone No. 703/305-4750

# INTERNATIONAL SEARCH REPORT

PCT/IB03/01129

## Continuation of Item 4 of the first sheet:

The title fails to meet the requirements of PCT Rule 4.3 which requires a short and precise title. The new title will be: 3G Measurements in PBCCH cell in dedicated GSM Mode.